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COAL BEDS IN SOUTHERN SOMERSET COUNTY, PENNSYLVANIA

By

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Introduction.

Somerset County ranks seventh in Pennsylvania as a bituminous coal producing county. In 1921 approximately 10,000,000 tons of coal were produced by commercial and custom coal mines; over 1,000,000 tons were produced in southern Somerset County. The coal from the Redstone and Pittsburgh beds is used almost entirely for locomotive steam coal, and that from the other beds is shipped east for use in different industries for steam purposes, and as domestic fuel.

Somerset County lies west of Allegheny Mountain and on the south line of the State. It is bounded on the west by Fayette and Westmoreland counties; on the north by Cambria County; and on the east by Bedford County. The area discussed in this report lies south of the line of 40° North Latitude, which extends east and west across the county, intersecting the southern borough limit of the town of Somerset. The townships producing coal in this district are: Addison, Elk Lick, Southampton, Summit, Brothers Valley, southern part of Somerset, Black, Milford, Middlecreek, and Upper and Lower Turkeyfoot.

There are fourteen coal beds of mineable thickness in the district The Lower Kittanning, Upper Kittanning, Upper Freeport, and Redstone beds are the most important at present. The Brookville, Clarion, Lower Freeport, and Pittsburgh (which is now practically exhausted), produce more than 1,000,000 tons annually. The production from the remaining beds is confined almost entirely to local use.

For many years the production of southern Somerset County was limited almost entirely to the Pittsburgh bed. In the last few years the Redstone bed has been mined vigorously, but its area is limited and it will soon be exhausted. However, there are many other beds, chiefly in the Allegheny formation, which are yet practically

undeveloped and even unprospected in large areas. These beds furnish the bulk of future production. Prospecting and geologic work in this district have established the fact that the beds in the Allegheny and Conemaugh formations are generally thin, averaging, in most cases, less than 3 feet thick. The beds are lenticular; invariably they are subject to roof and bottom "rolls" and in some places to wide "rock faults." In the next few years mining will be confined almost entirely to local areas where the beds are very regular and have excellent quality. With the installation of picking tables and washeries not only will the quality of the shipping coal be bettered and demand increased, but much coal can be saved by shipping one or more grades from mines.

The main line of the Baltimore and Ohio railroad enters this district at Hoblitzell, runs west to Meyersdale, and follows Casselman River through the western boundary of the county. Numerous branches serve the district south of Meyersdale, Berlin, Pinehill, Somerset, and the coal mining centers in the Johnstown and Wilmore basins. The district is traversed by many improved roads most of which were recently constructed. The township roads are dirt and are kept in good condition. During times of excessive prices thousands of tons of coal are hauled over these roads to sidings.

These excellent transportation facilities enable this district to ship its coal readily. The greater part of the production is distributed along the Baltimore and Ohio railroad between Cumberland and New York. Many tons are shipped yearly to tidewater and to the lakes.

Allegheny and Negro Mountains are the chief topographic features of the county. Allegheny Mountain, separating Elk Lick and Greenville townships, is a high narrow ridge with a crest averaging 2900 feet above tide. West of this mountain lies the beautiful Berlin-Salisbury basin. This basin is 9 miles wide from the crest of Allegheny Mountain to the crest of Negro Mountain. The center of the basin is decidedly hilly and cut by many streams. Allegheny Mountain has a steep and rugged slope, and Negro Mountain a gradual one. Casselman River flows in the center of the basin from Salisbury north to Meyersdale, and northwest to Garrett. A few miles west of this place it cuts the broad high ridge of Negro Mountain. The highest point so far discovered in Pennsylvania, 3210 feet, is on this mountain about 6 miles northwest of Salisbury. The Confluence-Johnstown basin, northwest of Negro Mountain, is extremely hilly; streams have cut deep channels and flow in V-shaped valleys. Laurel Hill forming, in part, the western boundary of this district, is another distinct topographic feature.

STRUCTURE.

Six structural features, each having a general northeast-southwest trend, have been recognized and mapped in a preliminary manner. They are, in order from east to west: Wellersburg syncline; Savage Mountain anticline; Berlin-Salisbury syncline (continuation of the Casselman syncline of Maryland); Negro Mountain anticline (continuation of Accident anticline of Maryland); Confluence-Johnstown syncline (Lower Youghiogheny syncline of Maryland); Laurel Hill anticline.

The Wellersburg syncline is a deep, narrow basin east of Allegheny Mountain. Its axis extends through the town of Wellersburg northeastward and passes near Williams Station on the main line of the Baltimore and Ohio railroad. Its total length in Somerset County is 10 miles. The deepest point in the basin is near Wellersburg where remnants of the Monongahela formation cap the hilltops. The basin gradually rises northeastward and ends in Bedford County.

Mount Savage anticline enters the State two miles southwest of Pocahontas and leaves the county two miles east of New Baltimore. The rocks dip steeply on both its flanks. The structure is regular and there is no pronounced variation of dip in its total length of about 18 miles in Somerset County.

The Berlin-Salisbury basin, lying northwest of Allegheny Mountain anticline, enters the district on the State line 2 miles south of Salisbury. Its axis extends in a northeastern direction just west of Salisbury, Meyersdale, Pinehill, and Berlin. It is a typical canoe-shaped syncline, the rocks rising rapidly to the crest of Allegheny Mountain on its eastern flank. The rise is more gradual and uniform on its western slopes. The deepest part of the basin is just south of Meyersdale. From this point the axis rises gradually northeast to Berlin, and southwest, slowly at first, but increasing rapidly until the Pittsburgh bed is lifted out of the hills near the Maryland State line. The axis of the basin is slightly tilted and as a result, the trough deepens southwestward in the direction of the tilt.

Negro Mountain anticline enters the district about 2 miles east of Oakton, extends along Shoemaker Run, Glade Mountain, Lick Run, Blackfield, and leaves the district about 3 miles southwest of Shanksville. This anticline is broad, rising rapidly and highest in Addison and Elk Lick townships where the lowest member of the Pocono formation is exposed. The axis gradually dips northeastward and the anticline flattens out in Black and Brothers Valley townships.

The Confluence-Johnstown basin lying northwest of Negro Mountain anticline, is broad and comparatively flat, being approximately 15 miles wide from the crest of Negro Mountain anticline to the crest of Laurel Hill anticline. The Conemaugh and Allegheny formations are exposed in almost its entire area. The axis enters the county near Confluence, extends northeast and leaves the southern district near Lavansville, a few miles west of Somerset. This basin contains a minor anticline and syncline on its eastern flank near Rockwood and Casselman which were formerly supposed to be a continuation of the Wilmore basin in northern Somerset County. The rocks rise slowly and evenly on the western flank.

Laurel Hill anticline, on the western edge of the county, is a great fold that has brought the Pottsville and Mauch Chunk rocks to outcrop. Its axis is highest on the county line southeast of Wilpen; from that point it dips gradually north and south.

STRATIGRAPHY.

The outcropping rocks of this district belong to the Quaternary, Carboniferous, and Devonian systems.

The Quaternary system is represented by river deposits of recent age composed of sands, clays, and gravel, which the streams have deposited on their flood plains in times of high water. This formation is limited principally to the valley of Casselman River between Salisbury and Garrett. The Carboniferous system is represented by the Monongahela, Conemaugh, Allegheny, Pottsville, Mauch Chunk, and Pocono formations. The Devonian is represented by the Catskill and Chemung formations.

The Monongahela formation is confined entirely to the hilltops in the Berlin-Salisbury and Wellersburg basins. It contains two workable coal beds, the Pittsburgh and the Redstone. The formation is extremely shaly, but also contains two sandstones and three or more limestones averaging about 4 feet thick.

The Conemaugh formation outcrops along the flanks of the anticlines in the Berlin-Salisbury basin, and along Casselman River and its tributaries west of Rockwood. It is composed chiefly of olive-green and red shales with interbedded limestones and coal beds. In the entire thickness of 875 feet there are but few massive sandstones.

The Allegheny formation underlies practically the entire district. It outcrops on the flanks of the anticlines on both sides of the Berlin-Salisbury basin and along stream-valleys west of Rockwood. It is composed of massive sandstones, coal, and clay beds, shales, and a few beds of limestone. Its average thickness is 250 feet.

The Pottsville formation outcrops on the western slope of Allegheny Mountain and forms a large area of surface rocks on the crest of Negro Mountain. It is composed of two or more massive sandstones which are locally conglomeritic. Between these sandstones are intervals of shale which sometimes contain two or more impure coal beds.

The Mauch Chunk formation is composed entirely of red and olive-green shales, and thin layers of interbedded red sandstone. The Greenbrier limestone, occurring in three or four different benches separated by red shale, lies at the base of this formation, and is locally quarried for lime. The Mauch Chunk formation is not coal-bearing.

The Pocono, Catskill and Chemung formations, outcropping only on the crests of Negro and Allegheny Mountains, are composed principally of shales, and a few massive sandstones that form the crests of the ridges.

COALS.

The following table shows the stratigraphic relation of the coal beds, their average thickness and the average intervals between them.

COAL BEDS IN SOUTHERN SOMERSET COUNTY.

Formation	Bed	Average Interval	Average Thickness
Monongahela			
	Redstone		4' 0"
		25	
	Pittsburgh (Big Vein)		5' 0"
		160	
	Lonaconing		4' 0" (very dirty)
		155	
	Wellersburg		1' 0"
Conemaugh 875'		60	
	Barton		1' 6"
		210	
	U Bakerstown		2' 0" (very dirty)
		40	
	L Bakerstown		1' 6"
		240	
	U Freeport (E)		3' 0"
		50	
	L Freeport (D)		2' 0"
		25	
	U Kittanning (C')		3' 0"
		60	
	M Kittanning (C)		1' 0" (very dirty)
Allegheny 250'		50	
	L Kittanning (B)		2' 4"
		30	
	Clarion (A')		2' 8"
		15	
	Brookville (A)		5' 0" (very dirty)
		10	
Pottsville 300'	No workable coal		

SUMMARY OF COALS BY FORMATIONS.

Pottsville Formation.

The Pottsville formation in southern Somerset County, contains three or more coal beds which are extremely impure and will never be commercially valuable. In large areas their horizon is represented by an impure bituminous shale high in ash, and carrying many small concretions of iron carbonate and "sulphur balls."

Allegheny Formation.

The Allegheny formation contains the greatest number of mineable coals, and most of the present production in this district comes from these beds.

Brookville ("A") Coal. This bed, lying at the base of the Allegheny formation and 45 feet below the Lower Kittanning, is very persistent. The bed averages 5 feet thick, but is only locally of commercial quality. In general, the bed is very thick and is divided into many benches by numerous shale partings. The merchantable coal is high in sulphur and ash.

Clarion ("A'") Coal. This bed, lying 30 feet below the Lower Kittanning, averages about 2 feet 8 inches thick in the entire district. Locally it is from 3 to 5 feet thick and a few commercial coal mines have been opened in it. Farmers have mined this bed in a few places for domestic use. The bed is characterized by many thin shale binders and many "sulphur balls."

Lower Kittanning ("B") Coal. This bed averages about 2 feet 4 inches thick and is fairly clean. The sulphur and ash content is rather high for a standard steam coal. This bed is mined on Buffalo and Coxe's creeks, and on its eastern outcrop in the Berlin-Salisbury basin.

Middle Kittanning ("C") Coal. This bed, lying 50 feet above the Lower Kittanning, is generally extremely impure where thickest. Locally the bed is less than 18 inches thick, but its quality is good. This bed has not been prospected or mined in this district.

Upper Kittanning ("C'") Coal. This bed, lying 75 feet below the Upper Freeport, averages 3 feet thick, but is mined only in localities where it is thickest, viz: on Buffalo, Coxe's, and Whites creeks. The bed contains numerous shale and bone binders and is locally high in ash and sulphur. When properly cleaned it is a good grade steam coal.

Lower Freeport ("D") Coal. The Lower Freeport coal, lying 50 feet below the Upper Freeport, averages 3 feet thick, but is only locally of commercial value. This bed is mined at a few places on Buffalo and Coxe's creeks. When prices are high this bed is mined

with varying success in the vicinity of Rockwood where it has a maximum thickness of 5 feet 4 inches including impurities. A large shale and bone binder near the middle of the bed, which is characteristic in most localities, increases production cost and lowers the quality of the run-of-mine coal, as this binder cannot be completely removed by picking.

Upper Freeport ("E") Coal. The Upper Freeport coal is mined in the southern part of the Berlin-Salisbury basin and on Buffalo and Coxe's creeks. This bed is generally thin, averaging about 30 inches, and has fairly good quality. The bed is subject to "rolls" both on roof and bottom, which makes mining rather hazardous.

Conemaugh Coals.

The Conemaugh formation contains 18 coal beds, five of which are locally workable. These beds may have future importance when the thicker beds are exhausted.

Lower Bakerstown Coal (Thomas coal of West Virginia and Maryland). This bed, lying 240 feet above the Upper Freeport, is opened by farmers on the eastern slope of Negro Mountain. The bed ranges from 12 inches to 2 feet 10 inches thick. Where thin the coal is excellent, but in most localities the bed has numerous small bone partings.

Upper Bakerstown Coal (Maynadier coal of Maryland). This bed, lying 40 feet above the Lower Bakerstown, averages about 2 feet thick in the Berlin-Salisbury basin, but west of Negro Mountain its horizon is represented by several feet of bituminous shale. This coal has not been prospected to any great extent, but local outcrops indicate that it may have some commercial value.

Barton Coal. The Barton coal, lying 490 feet above the Upper Freeport, averages 12 inches thick, and has excellent quality. Locally it has a maximum thickness of 2 feet 6 inches, and is mined by farmers for domestic fuel. The bed is extremely lenticular and subject to "squeezes."

Wellersburg Coal. The Wellersburg coal at its type locality at Wellersburg in Southampton township, Somerset County, has a maximum thickness of 5 feet. It has been opened for local use. This bed is thin and unimportant in Somerset County west of Allegheny Mountain. It lies 315 feet below the Pittsburgh bed in the Berlin-Salisbury basin.

Lonaconing Coal (Elk Lick coal of Rodgers). The Lonaconing coal, lying about 160 feet below the Pittsburgh, is very thin, except on Elk Lick Creek where it has a maximum thickness of 4 feet and is being mined for local use.

Monongahela Formation.

The Monongahela formation is confined to a small area in the hilltops in the Berlin-Salisbury basin.

Pittsburgh Coal. The Pittsburgh coal, which is now practically exhausted, has been the greatest producer from this formation. Mining is limited now to impure "crop" coal and the pulling of old pillars.

Redstone Coal. The Redstone bed, lying at an average interval of 25 feet above the Pittsburgh bed, is now the most important coal in the district south of Meyersdale. It averages about 4 feet thick but is inferior in quality to the Pittsburgh bed.

Sewickley Coal. The Sewickley and possibly the Waynesburg beds are in the hilltops south of Meyersdale. They are thin and will never be of commercial value because they have been leached by surface water. The Sewickley bed occurs also in the summits near Pinehill, and is known locally as Pine Hill No. 1 bed. It is being mined and shipped as a fair grade steam coal.

WELLERSBURG BASIN

Southampton Township.

The Wellersburg basin is a continuation of the Georges Creek basin in Maryland. The Georges Creek basin has produced enormous tonnages of excellent steam coal for many years. Unfortunately the main bed, the Pittsburgh, becomes dirty and inferior in quality in the vicinity of Wellersburg. This small district has had a very small production and has never been fully prospected. Diamond drilling will probably prove that this field has one or more excellent coal beds in the Allegheny and Conemaugh formations.

Pittsburgh Coal. The production of this district is confined to the Pittsburgh bed which occurs in the hilltops north of Wellersburg. The bed averages 8 feet thick, but only 5 feet 6 inches is merchantable coal. Many shale and bone partings make mining difficult and the coal must be picked before it is shipped. The quality is below the standard of the Pittsburgh bed, the sulphur and ash content being rather high.

The coals beneath the Pittsburgh bed have never been definitely correlated with those of Maryland. The lack of geologic work in this field warrants the use of information already collected by the Maryland State Geological Survey in adjacent territory.

Conemaugh Coals.

The Little Pittsburgh coal, opened near Wellersburg, ranges from 2 feet 8 inches to 2 feet 10 inches of clean coal of fair quality, with one 2-inch bone parting.

A bed of clean coal 20 inches thick is approximately at the horizon of the Franklin coal of Maryland. There are four other coal beds in the Conemaugh formation. The first, in descending order, lies 425 to 440 feet below the Pittsburgh bed, and has been opened for custom coal. It averages 4 feet thick, but is divided in the middle by shale partings ranging from 2 inches to 2 feet thick. The second bed lies approximately 490 feet below the Pittsburgh. It has not been prospected, but the thickness and quality on its outcrop indicate slight commercial value. A coal 2 feet 10 inches thick has been reported 585 feet below the Pittsburgh bed. The lowest Conemaugh coal lies 675 feet below the Pittsburgh bed, and averages 22 inches thick. Its commercial possibilities are slight.

Allegheny Coals.

A coal 740 feet beneath the Pittsburgh bed has been doubtfully correlated with the Upper Freeport. It is divided into two benches by a shale parting 6 to 12 inches thick; the upper bench ranges from 2 to 3 feet thick, and the lower bench from 12 to 18 inches thick. A diamond drill record shows a 4 foot coal 50 feet below this bed. This thickness has not been verified. A bed lying 130 feet below the supposed Upper Freeport is reported to be 5 feet thick, but of inferior quality.

BERLIN-SALISBURY BASIN.

Elk Lick Township.

Brookville ("A") Coal. The Brookville coal, lying at the base of the Allegheny formation, outcrops near the summit of Allegheny and Negro mountains. This bed has been prospected at numerous places and has been found to be extremely dirty and of no commercial value.

Clarion ("A'") Coal. The Clarion coal, lying about 15 feet above the Brookville, has also been prospected on the slope of Negro and Allegheny mountains, but at no place was the quality good enough to warrant mining. The bed averages 2 feet 10 inches thick, of which only 18 inches is clean coal.

Lower Kittanning ("B") Coal. The Lower Kittanning coal outcrops high up on the slopes of Negro and Allegheny mountains. This bed has been prospected on the Davis Estate on the eastern slope of Negro Mountain. It averages 2 feet thick, and has good quality. The future commercial importance of this bed is uncertain.

Middle Kittanning ("C") Coal. The Middle Kittanning coal is a thin, irregular bed having no promise of future value. It is absent in large areas and in others its horizon is represented by several feet of carbonaceous shale.

Upper Kittanning ("C'") Coal. The Upper Kittanning coal, outcropping on the slopes of the basin, is locally very good. This bed is subject to roof "rolls" and is "faulted out" in large areas. This

bed may be used locally in the future for domestic fuel.

Lower Freeport ("D") Coal. The Lower Freeport is a thin, extremely irregular bed, outcropping on both flanks of the basin. Although the quality is good, numerous prospects have found only local areas of merchantable coal.

Upper Freeport ("E") Coal. The Upper Freeport coal, outcropping about halfway up the slope of Negro and Savage mountains, is being mined by drift for local use. This bed gives more promise of future value than any other coal in the Allegheny formation. It averages 3 feet thick in Elk Lick township. The largest production comes from the vicinity of Engle's Mills and Boynton where 3 feet is the common thickness. The physical character of the bed varies greatly in short distances. However, there are always two or more shale partings varying from 1 to 14 inches thick. The coal is soft and friable but is excellent for steaming purposes. This bed has also been opened by farmers for domestic use on the eastern slope of Negro Mountain. On the headwaters of Tub Mill Run it is 2 feet 4 inches thick and has excellent quality, but as this region is practically uninhabited and little prospecting has been done, it is impossible to say whether this thickness and quality is general.

Conemaugh Coals. The Conemaugh coals outcrop on both flanks of the basin but have been prospected only on the eastern slope of Negro Mountain, particularly on Tub Mill Run. The Lower Bakerstown coal, opened for farm use, ranges from 18 inches to 3 feet 2 inches thick. It is extremely dirty. The Upper Bakerstown coal is thinner but of better quality. The Barton coal has been opened at one place on Tub Mill creek, and ranges from 2 feet to 3 feet 2 inches thick. Underneath this is a 5 foot bed of clay excellent for making brick.

Pittsburgh Coal. The Pittsburgh bed has been almost entirely exhausted in this township. The bed averages about 7 feet thick. At Salisbury the coal is in five benches, 5, 12, 30, 36, and 33 inches thick, separated by several 1/8 to 2 inch bone partings. The Pittsburgh bed ranges from 5 feet 6 inches to 6 feet 6 inches thick on Coal Run. It always has two or more thin bone partings. Production is limited to one stripping operation and a few mines which are pulling pillars and mining "crop" coal.

Redstone Coal. The Redstone bed is mined by drift well up on the slopes of the hills in the center of the basin, west and northwest of Boynton. The bed averages 4 feet 2 inches thick. At Salisbury it is 5 feet 2 inches thick including several thin shale partings; at Boynton the coal is 3 feet 8 inches thick not including two 6-inch shale partings; on Coal Run it averages 4 feet 4 inches thick not including 4 feet of impure roof coal. The main bed is generally divided into two or more benches by 1-to-4 inch bone partings. The quality is much inferior to that of the Pittsburgh, but it is a good steam coal. Much of the Redstone bed in this township is lost by undermining in the Pittsburgh bed.

Sewickley Coal. The Sewickley coal, capping the hilltops northwest of Coal Run, is thin and impure, and will never be of commercial value.

Summit Township.

The Brookville ("A") and Clarion ("A'") beds, outcropping on both flanks of the basin, are thick but extremely impure beds without promise of future commercial value.

Lower Kittanning ("B") Coal. This bed outcrops on the western slope of Allegheny Mountain and on the eastern slope of Negro Mountain. It has not been prospected, but outcrop measurements range from 8 inches to 2 feet 4 inches. The bed has one or more thin bone or shale partings, in addition to a one-half inch streak of "sulphur" on the top.

Middle Kittanning ("C") Coal. The Middle Kittanning coal ranges from 18 inches to 4 feet thick. It has not been prospected, but it is doubtful whether it will be of commercial value even locally.

Upper Kittanning ("C'") Coal. The Upper Kittanning coal outcrops on both flanks of the basin. Where opened at one locality on the western slope of Allegheny Mountain for farm use it is 2 feet thick and comparatively clean. The bed is mined for shipment in the vicinity of Garrett where it averages 4 feet thick. It is divided into two or more benches by shale partings averaging one-half inch thick. The lower bench, averaging 22 inches, is very poor in quality. This bed has not been prospected to any great extent on the eastern slope of Negro Mountain, but outcrop indications are that it may locally be a fairly thick bed of good coal.

Lower Freeport ("D") Coal. The Lower Freeport coal ranges from 8 inches to 3 feet thick in this township. It is opened for local use on the eastern slope of Negro Mountain near Handwerk school. It is divided into two benches by 12 inches of fire clay. The upper bench is 2 feet 8 inches thick; the lower bench, which is 2 feet thick, has many "knife blades" of bone and pyrite. The only commercial mine in this bed is at Garrett where the bed averages 2 feet 10 inches thick, including two thin bone partings. The coal has fairly good quality.

Conemaugh Coals. The Conemaugh coals are generally thin and unimportant in this township. They have not been prospected to any great extent and may prove to be valuable locally. The Lower Bakerstown coal is opened on Casselman River one mile southeast of Garrett, where it averages 2 feet 6 inches thick including one $\frac{1}{4}$-inch shale parting and one $\frac{1}{2}$-inch bone parting. The coal is fair in quality.

A coal, locally known as the Elk Lick, lying about 160 feet below the Pittsburgh, has been correlated in this report with the Lonaconing of Maryland. This bed has an unusual local thickness of 4 feet on Elk Lick Creek. It was formerly mined for local use. The physical character of the bed is extremely variable, but three or more shale partings from 1 to 2 inches thick are always present. The

coal is rather high in ash and sulphur.

Pittsburgh Coal. The Pittsburgh bed thins northward from Elk Lick township and the partings increase in thickness. South of Casselman River the production from the Pittsburgh bed is limited to the pulling of pillars in the old mines. On the hills north of Meyersdale, where the bed is extremely thin and poor in quality, it is mined by drift. The bed ranges from 2 feet 8 inches to 4 feet thick, and contains two or more bone partings ranging from 3 to 10 inches thick. Locally the bed contains numerous "sulphur balls." One mile southwest of Miller school the bed is 5 feet 10 inches thick including a bottom bench of 30 inches of dirty coal which is not mined for shipment, and also a 6-inch bone parting 18 inches from the top. At Shaw Mines the Pittsburgh bed is divided into three benches. The top bench averages 5 feet 10 inches thick and has excellent quality. A 10-inch binder of shale (black-jack) separates this bench from a middle bench which averages 7 inches thick. A 6-inch shale parting separates the middle from the lower bench, which is 22 inches thick. Locally these two lower benches are of good quality and are "loaded," but they are left in most mines.

Redstone Coal. The Redstone bed is mined by drift in the hill-tops south of Meyersdale, principally at Shaw Mines. It averages 4 feet 6 inches thick, but invariably contains three or more thin bone partings which are removed carefully in mining. Although it does not have the thickness or quality of the Pittsburgh bed, it is extensively mined on the properties where the Pittsburgh bed has been mined out. It yields a large percentage of the total output of the basin.

Brothers Valley Township.

Brookville ("A") and Clarion ("A′") Coals. These coals have not been prospected to any great extent in this township. They outcrop well up on the slopes of Alleghony and Negro mountains in a practically uninhabited district. During field work in this township in the summer of 1922 the writer observed these beds in many outcrops but is inclined to think that their commercial value is extremely uncertain. Locally they are thin beds having fairly good quality, but within a few yards they thicken up and partings come in that entirely destroy the value of the coal.

Lower Kittanning ("B") Coal. This bed underlies practically the whole township, but in most localities can be mined only by shaft. Drill hole records and outcrop measurements indicate that this bed averages less than 3 feet thick. The only commercial development is at Macdonaldton where the bed averages about 6 feet thick, including one or more thin bone partings and a lower bench of impure coal ranging from 6 inches to 2 feet 9 inches thick. This lower bench usually is not mined for shipment but is taken up in rooms and headings for height.

Middle Kittanning ("C") Coal. The Middle Kittanning coal is thin and unimportant in this township. Its horizon is generally represented by a few inches of carbonaceous shale.

Upper Kittanning ("C'") Coal. The Upper Kittanning coal is one of the most important beds in Buffalo Creek valley northeast of Garrett. Many mines have been producing from this bed for several years, but large reserves still remain. This bed underlies practically the entire county, but is most easily accessible and of best quality on Buffalo Creek where it ranges from 2 feet 8 inches to 4 feet 2 inches thick, averaging about 3 feet 4 inches. There are no characteristic impurities in the main part of this bed but in most localities a few inches of bone coal are present both on top and bottom. Locally one or more thin bone binders are present. In several localities the coal has been cut out entirely by sandstone "faults."

Lower Freeport ("D") Coal. The Lower Freeport coal is present in large areas in the township but is opened principally on Buffalo Creek. It is also opened in the eastern and northern parts of the township for local use. On Buffalo Creek the bed ranges from 22 inches to 3 feet 2 inches thick, and contains one or more local bone partings. The bed is very lenticular and is subject to "rolls" on roof and bottom which make the thickness very irregular. The coal is high in ash and sulphur.

Upper Freeport ("E") Coal. This bed is a thin but very good coal throughout the entire township. It is used for local fuel in the eastern and northern parts of the township, but its commercial development is limited to Buffalo Creek valley, where it is easily accessible by drift well up the slopes of the hills. The bed averages 2 feet 6 inches thick, is very irregular, and only locally contains one or two thin bone partings. In some mines, 12 inches of dirty bony coal is on the bottom. This is mined only when additional height is desired.

Pittsburgh (Pine Hill No. 2) Coal. As a result of several years study by the Maryland and Pennsylvania Geological Surveys, the Pine Hill No. 2 bed has been correlated as the stratigraphic equivalent of the Pittsburgh bed, and the Pine Hill No. 1 bed as the Sewickley. This correlation has met with the approval of mining engineers in this district.

The Pittsburgh bed is mined by drift in the vicinity of Pinehill where it ranges from 2 feet 8 inches to 4 feet 6 inches thick. The bed is never entirely free from impurities. A lower bench, ranging from 8 inches to 2 feet 10 inches thick, is usually full of "sulphur" streaks. The upper part of the bed commonly is parted by two or more shale binders ranging from ¼ to 12 inches thick. In general the bed is very regular. Locally "sandstone faults" partly cut out the bed. This coal is used for steaming purposes. It is picked by the miners and on the car before shipment.

Redstone Coal. The Redstone bed is the stratigraphic equivalent of the Platt coal of the Second Pennsylvania Geological Survey. This

bed is extremely irregular in thickness and variable in quality, and no commercial mines are worked in it. Its horizon is usually represented by several feet of coal mixed with thick shale partings or carbonaceous shale.

Sewickley (Pine Hill No. 1) Coal. The Sewickley coal is mined by drift near the tops of the hills in the vicinity of Pinehill and Berlin. The bed ranges from 3 feet to 4 feet 6 inches thick, averaging about 4 feet. Invariably it has a bony coal or "draw slate" roof. The main bed is separated by bone or shale partings ranging from ¼ to 4 inches thick, into three or more benches.

CONFLUENCE-JOHNSTOWN BASIN.

Black Township

Brookville ("A") Coal. The Brookville coal outcrops near the top of Negro Mountain anticline in Black township. The bed lies almost directly upon the Pottsville conglomerate, and is irregular in thickness and variable in quality. Very few openings have been made in this bed because of its inferior quality due chiefly to thick bone and shale partings. Locally in the vicinity of Wilson Creek the bed is 7 feet thick, of which only 3 feet 6 inches is merchantable coal, high in sulphur and ash.

Clarion ("A′") Coal. The Clarion coal outcrops on the crest of Negro Mountain and in the Coxe's Creek valley. It is mined by drift in the vicinity of Blackfield, Wilson Creek, and Murdock. The bed averages 5 feet 6 inches thick at Blackfield, including three or four shale partings usually about 8 inches thick. A lower bench 20 inches thick is too dirty to be mined profitably. The bed is very irregular because of "rock rolls" on the roof. The Clarion coal averages 4 feet 2 inches thick at Wilson Creek, including two or three bone and shale partings ranging from 4 to 10 inches thick. The main bench, which is good coal, averages 3 feet 6 inches. At Milford the bed averages 5 feet 6 inches thick, including two persistent shale partings ranging from 1 to 3 inches thick, and numerous "knife blades" of bone and "sulphur." The bed is extremely variable in thickness and "sandstone faults" often entirely cut out the coal. Sulphur is common, occurring in the form of pyrite. The importance of this bed is normal times is slight.

Lower Kittanning ("B") Coal. The Lower Kittanning coal outcrops on the hills on the eastern bank of Coxe's Creek, and is mined by drift at many places along the valley. The bed averages about 4 feet thick, including impurities. The greater part of the merchantable coal comes from a middle bench which ranges from 15 to 18 inches thick. This bench is separated from the top and bottom benches by ½ to 2-inch shale partings. An impure bottom bench ranges from 2 inches to 2 feet 4 inches thick. This bench is not mined for shipment but is taken up in rooms and headings for height. The bed is

3 feet thick at Rockwood, including a ½-inch bone parting in the middle and 6 inches of bone on the bottom. The coal throughout this district is high in sulphur owing to the presence of numerous "sulphur" streaks and nodules.

Middle Kittanning ("C") Coal. The Middle Kittanning coal is thin and unimportant in this township. Its horizon is marked by a few inches of impure bony coal.

Upper Kittanning ("C'") Coal. The Upper Kittanning coal outcrops in the valleys of Coxe's Creek and Casselman River. It has been mined in few localities. The bed averages about 3 feet 4 inches thick, including numerous shale partings. Locally the bed is divided into two benches by 3 to 4 feet of fire clay. The upper bench ranges from 12 to 22 inches thick; the lower one from 2 feet 2 inches to 2 feet 8 inches. This fire clay parting is characteristic in the vicinity of Casselman.

Lower Freeport ("D") Coal. The Lower Freeport coal outcrops on the hills on the eastern bank of Coxe's Creek, and on Casselman River southwest of Rockwood the bed averages about 2 feet 6 inches thick. The top bench, which is 21 inches thick, is fairly clean and is separated from an impure bottom bench by a bone and shale parting averaging 18 inches thick. The bottom bench is rarely loaded for shipment.

Upper Freeport ("E") Coal. The Upper Freeport coal outcrops and is mined by drift high on the hills on the eastern slope of Coxe's Creek and on Casselman River southwest of Rockwood. The bed varies much in thickness and quality locally, and has no characteristic impurities with the exception of small lenses of pyrite. The bed varies from 2 feet 4 inches to 3 feet 8 inches thick in the Coxe's Creek valley. A top bench ranging from 18 inches to 2 feet 6 inches thick is fairly good coal. Below this main bench are several smaller benches of coal alternating with thick bone binders. This bottom coal is not mined. The coal is thickest under a shale roof.

Southern Part of Somerset Township.

The Brookville ("A"), Clarion ("A'"), and Middle Kittanning ("C") Coals are not mined in this district.

The Lower Kittanning ("B"), Upper Kittanning ("C'"), and Lower Freeport ("D") coals have been opened for local use. These beds are extremely variable in thickness and quality. During the period of high prices coal from these beds was hauled by wagon and loaded on sidings. These beds are locally 3 feet thick, but decrease within short distances to a foot or less.

Upper Freeport ("E") Coal. The Upper Freeport coal is mined in the vicinity of Somerset, where it averages 3 feet 6 inches thick. The roof is bony coal, underneath which is a bench of clean coal ranging from 2 to 3 feet thick. Beneath this clean bench is three or four smaller benches of coal separated by thick bone partings. This

coal is not mined. A small and extremely irregular "rider" bed lies about 18 feet above the Upper Freeport, and ranges from 3 to 6 feet thick. This coal is canneloid in character and has an ash content varying from 10 to 20 per cent. At one or more places this bed is mined and sold locally as a cannel coal.

Milford Township.

All the coals in the Allegheny formation outcrop in Milford township. Only reconnaissance work has been done in this vicinity, and no definite statements can be made of the quality and thickness of the coals except in the valleys of Coxe's Creek and Casselman River.

Lower Kittanning ("B") Coal. The Lower Kittanning coal is thin in this district, averaging 2 feet 2 inches thick. Its quality is good, the ash and sulphur content being fairly low. The bed is remarkably free from impurities and is very regular in thickness. East of Casselman, along Casselman River, the Upper Kittanning coal is a double bed separated by a hard fire clay parting ranging from 2 to 7 inches thick. The top bench is 2 feet 2 inches thick, not including 4 inches of bony coal on the roof. The lower bench is 4 feet 2 inches thick but has two thick bone partings. The lower 6 inches is canneloid.

Lower Freeport ("D") Coal. The Lower Freeport coal is mined on Coxe's Creek north of Rockwood, where it averages 3 feet 6 inches thick. A bone parting ranging from 7 to 14 inches thick separates the bed into two benches. The top bench averages 2 feet 3 inches thick, and the lower one ranges from 8 to 20 inches thick. Locally there is another thin bench of coal on the bottom ranging from 2 to 6 inches thick. This bench is not mined.

Middlecreek Township.

Middlecreek township lies on the eastern slope of Laurel Hill and is very thinly populated. Railroad facilities are poor and little prospecting has been done on the coal beds. This Survey has not done detailed work in this township and can make no definite statements as to the thickness and quality of the coals. During a reconnaissance field trip made in the summer of 1921 the writer noted several promising outcrops in the vicinity of Barronvale and Fall Creek. These outcrops indicated that two or more beds are of mineable thickness and probably of fair quality. No attempt has been made to correlate them.

Upper and Lower Turkeyfoot Townships.

The outcropping rocks in this area belong to the Allegheny and Conemaugh formations. None of the Conemaugh coals are merchantable at the present time. The Upper Kittanning is the most important bed in these two townships.

The Brookville ("A"), Clarion ("A′"), and Middle Kittanning ("C") Coals vary so much in thickness and quality that they have never been commercially developed. They may, however, prove to be of value locally when more prospecting has been done.

Lower Kittanning ("B") Coal. The Lower Kittanning coal is thin in the vicinity of Casselman, averaging 2 feet 2 inches, but has very good quality. It has been successfully mined by the use of longwall scraper loaders.

Upper Kittanning ("C′") Coal. The Upper Kittanning coal, the important coal in these townships, ranges from 4 to 9 feet thick, including many impurities. It is characteristically a double bed separated into two benches by a fire clay or shale parting ranging from 2 to 4 feet thick. "Draw slate" 4 to 6 inches thick is present at the top of the bed. The upper bench ranges from 16 inches to 2 feet 4 inches thick. Locally it is clean but generally has one or more thin shale partings. The lower bench ranges from 4 inches to 2 feet 8 inches thick, and locally is so dirty that it is mined for height in rooms and headings. The fire clay parting between the two benches is used for floor in mining the upper bench. At Humbert the Upper Kittanning coal averages 2 feet 10 inches thick. A shale parting from 2 to 4 inches thick is invariably present 2 to 6 inches above the bottom. Except for this one binder the coal is clean. The sulphur content is medium and the ash is low.

Lower Freeport ("D") and Upper Freeport ("E") Coals. The Freeport coals outcrop high on the hills on each side of Casselman River. They have not been mined. The little prospecting that has been done indicates that they are thin but very good quality. The Upper Freeport coal, in particular, has promise of value when the more important beds have been mined out. At Humbert the Upper Freeport coal has a maximum thickness of 5 feet 6 inches, including impurities. The top coal, 26 inches thick, is usually a good clean coal. The middle part of the bed has numerous thin bony partings. The bottom coal, ranging from 10 to 24 inches, has good quality.

Addison Township.

Brookville ("A") and Clarion ("A′") Coals. The Brookville and Clarion coals do not outcrop in Addison township. These coals have never been prospected to any great extent but are generally believed to be thin, dirty, and unimportant.

Lower Kittanning ("B") Coal. The Lower Kittanning coal outcrops at one or two places on Whites Creek. At Harnedsville it is 2 feet 10 inches thick, including numerous partings of bone and "sulphur." At Listonburg the bed occurs in one bench averaging 4 feet 4 inches thick, but is extremely dirty and high in sulphur, containing many thin shale partings and numerous lenses of iron pyrite.

Upper Kittanning ("C′") Coal. The Upper Kittanning coal is the most important bed in the Confluence-Listonburg district where it is

mined in many places by drift. Its importance has so overshadowed the other coals that they have never been prospected to any great extent. They are present, but their thickness and quality do not justify development at present, at least while large acreages of the Upper Kittanning bed remain unmined. The Upper Kittanning coal averages 3 feet 4 inches thick in the vicinity of Confluence. The top 24 inches is clean coal; the bottom 16 inches includes 1 inch of shale parting and 4 inches of bone coal at the base. At Harnedsville the upper bench, 3 feet thick, is separated from the lower bench 10 inches thick, by an 8-inch fire clay parting. At Beachley the bed ranges from 3 feet 2 inches to 4 feet thick. It is never entirely clean, but the partings are not persistent. In one mine, where the total thickness is 3 feet 8 inches, 12 inches at the top is a mixture of alternating bands of bone and coal. The remainder of the bed is clean. At another locality the bed is 4 feet thick and is clean with the exception of a ½ inch shale parting 24 inches above the bottom.

Upper Kittanning ("C'") Coal. The Upper Kittanning coal is mined extensively in the vicinity of Listonburg where it ranges from 3 feet to 4 feet 4 inches thick. The coal is high in sulphur and ash. With the installation of picking tables and washeries, this district would be able to increase its production, ship two grades of coal, and lower the percentage of loss in mining. In this vicinity the physical character of the bed varies greatly in short distances. Where thinnest the bed usually has no characteristic impurities with the exception of small lenses of bone and iron pyrite. Where thickest it is usually divided into one or more benches by one or more thin bone partings, and locally has 4 to 14 inches of bone coal on the bottom. This bone coal is not taken up in mining.

Lower Freeport ("D") and Upper Freeport ("E") Coals. The Freeport coals have been prospected at several points along the valley, but only locally do they have the good quality and thickness of the Upper Kittanning. The Upper Freeport coal probably is the better bed, but rarely is over 2 feet thick. It is mined in the vicinity of Somerfield where the bed ranges from 4 to 6 feet thick, including a clay parting in the middle ranging from 16 inches to 2 feet 4 inches thick. The upper bench is a good quality of coal, but the lower bench is locally very impure. The geology of this district has not been studied in detail, and as the reports of prospecting are very meager it is impossible to give any definite information. Numerous outcrops indicate that two or more beds may have future value as they may be mined in conjunction with beds of limestone and fire clay.

TABLE OF ANALYSES.

No.	Bed	H_2O	V.M.	F.C.	Ash	S.	B.t.u.
1.	Sewickley	2.58	21.53	67.97	7.92	1.66	13903
2.	Redstone	3.18	21.08	63.26	12.48	1.82	13016
3.	Redstone	2.73	19.63	64.99	12.65	2.30	13243
4.	Redstone	5.29	21.25	61.64	11.82	1.49	12227
5.	Pittsburgh	2.98	21.72	69.37	5.93	.88	14163
6.	Pittsburgh	3.59	22.69	68.12	5.60	1.14	14108
7.	Pittsburgh	3.03	20.35	67.77	8.85	1.02	13730
8.	Pittsburgh	5.62	19.99	63.58	10.81	.86	12523
9.	Pittsburgh	3.43	19.14	66.61	10.82	1.89	13316
10.	Barton	3.00	19.90	70.70	6.40	2.20	14060
11.	L. Bakerstown	4.10	18.40	70.20	7.30	.80	13990
12.	L. Bakerstown	3.68	18.88	69.72	7.72	2.34	13796
13.	U. Freeport	6.30	17.90	67.90	7.90	1.00	13240
14.	U. Freeport	3.50	20.70	66.60	9.20	1.80	13620
15.	U. Freeport	3.00	21.10	66.30	9.60	1.80	13590
16.	U. Freeport	4.00	19.60	67.70	8.70	3.10	13470
17.	U. Freeport	2.70	19.02	67.01	11.27	1.05	13343
18.	U. Freeport	3.21	20.44	65.18	11.17	1.72	13269
19.	U. Kittanning	3.22	17.61	68.92	10.25	2.55	13361
20.	U. Kittanning	2.54	20.69	64.68	12.09	2.27	13284
21.	U. Kittanning	2.35	23.20	62.02	12.43	3.57	13121
22.	U. Kittanning	2.34	24.16	61.33	12.17	3.98	13157
23.	U. Kittanning	2.80	25.94	63.06	8.20	2.35	13887
24.	L. Kittanning	3.40	22.50	67.30	6.80	1.00	13980
25.	L. Kittanning	1.13	15.36	73.48	10.03	0.93	13627
26.	L. Kittanning	1.03	16.03	72.57	10.37	2.22	13758
27.	L. Kittanning	2.90	21.05	62.74	13.31	2.71	12924
28.	L. Kittanning	2.74	20.13	64.68	12.45	2.81	13055
29.	L. Kittanning	2.73	20.31	67.40	9.56	2.30	13637
30.	Clarion	5.68	18.87	67.40	8.05	.89	13229

Locations from which samples were obtained are shown by corresponding numbers on following page.

Mines and Sample Locations.

No.	Company	Mine	Location
1.	Consolidation Coal	No. 112	Pine Hill, 2 mi SW
2.	Meyersdale Fuel	No. 3	Meyersdale, 6 mi. S
3.	Grassy Run Coal	Grassy Run No. 1	Salisbury, 2½ mi. NW
4.	Consolidation Coal	No. 105	Shaw Mines
5.	Boynton Coal Co.	Chapman No. 3	Salisbury; 3/4 mi. W
6.	Meyersdale Fuel	Merchants No. 3	Salisbury, 1½ mi. NE
7.	Consolidation Coal	No. 104	Shaw Mines
8.	E. Statler & Son	Statler	Meyersdale, ¼ mi. NW
9.	Consolidation Coal	No. 113	Pine Hill; 2 mi. SW
10.	Ward Compton	Country Bank	Salisbury; 2 mi. NW
11.	Henry Opal	Country Bank	Salisbury, 3 mi. NW
12.	Black Coal Co.	Black	Meyersdale; 3 mi. NW
13.	Pike	Country Bank	Meyersdale; 3 mi. S
14.	Lloyd Engle	Country Bank	Meyersdale, 1½ mi. SE
15.	Handwerk	Country Bank	Summit Mills; 3 mi. NW
16.	Johnson	Country Bank	Summit Mills, 2 mi. NW
17.	McAllen Coal	Garey	Garrett, 1½ mi.N
18.	Quemahoning Coal	No. 10	Rockwood, ½ mi. W
19.	Tri-State Collieries	Garrett Slope	Garrett, 1½ mi. N
20.	Marine Smokeless Coal	Marine	Casselman, ¼ mi. W
21.	Ursina Fuel	Mill Mine	Ursina
22.	Listonburg Coal	Miller	Listonburg
23.	------	Linmer	Confluence, 4½ mi. SE
24.	Davis	Prospect	Salisbury, 3 mi. NW
25.	Brothers Valley Coal	Pen Mar No. 2	MacDonaldton, 1½ mi. SW
26.	Brothers Valley Coal	Pen Mar No. 3	MacDonaldton
27.	M. A. Snyder	Snyder	Markleton, ¼ mi. E
28.	J. M. Murdock & Son	Milford No. 2	Rockwood; 6 mi. N
29.	McGregor Coal	McGregor No. 2	Rockwood, 4 mi. N
30.	Atlantic Coal	Atlantic No. 2	Garrett, 5 mi. NW